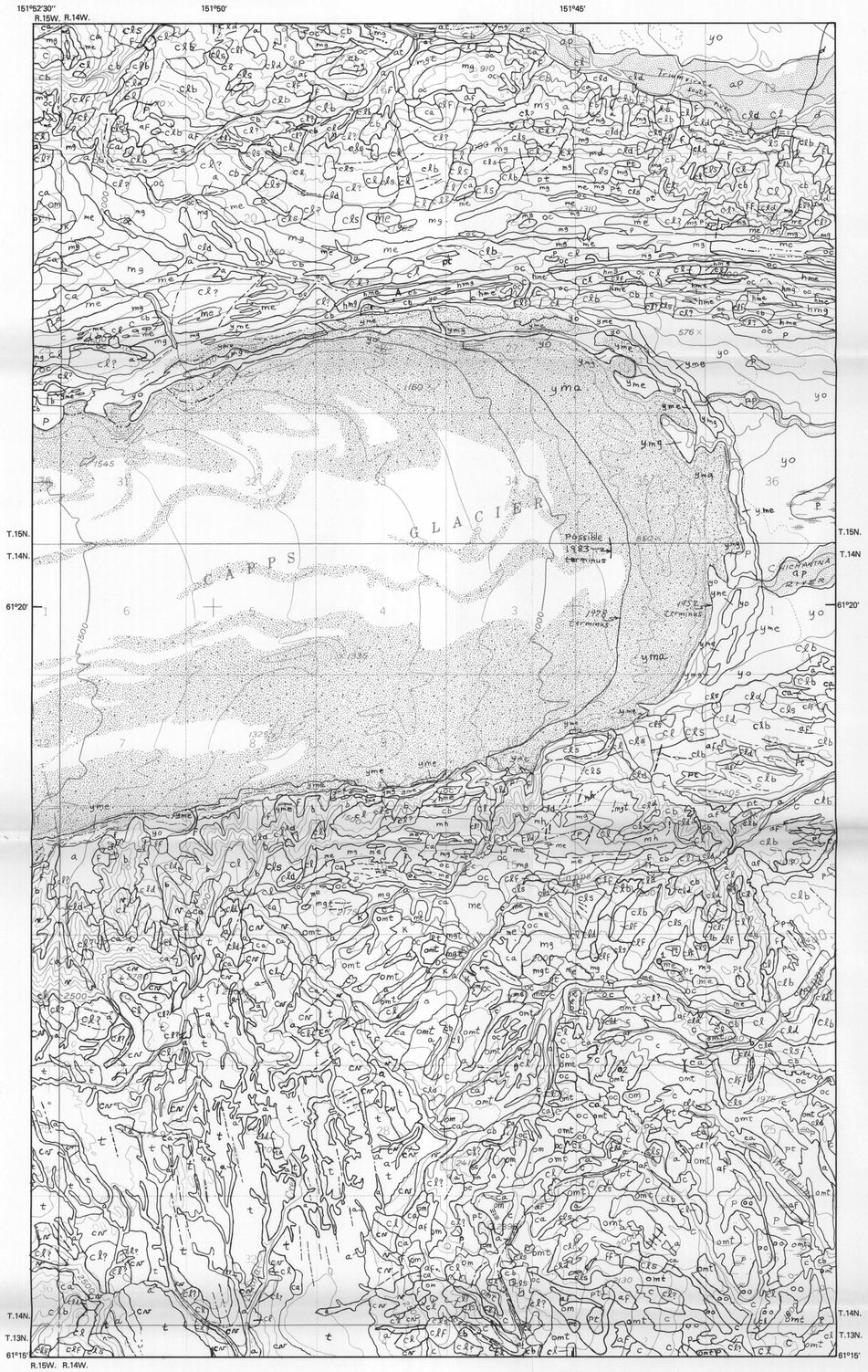
MISCELLANEOUS FIELD STUDIES
MAP MF-1661-B

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY



Base from U.S. Geological Survey 1:63,360, 1958
Topography by photogrammetric methods from aerial photographs taken in 1952

Surficial geology mapped chiefly by L. A. Yehle using year 1952 airphotos. Field checked by L. A. Yehle, H. R. Schmoll, and A. F. Chleborad, 1978, 1979, and 1980, and by L. A. Yehle and H. R. Schmoll, 1981; assisted by J. M. Core, 1978, C. A. Gardner and A. D. Pasch, 1979 and 1980, and C. A. Gardner and J. K. Odum, 1981.

MAP LOCATION

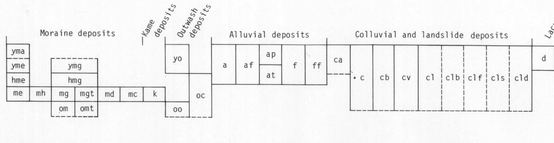
PRELIMINARY SURFICIAL GEOLOGIC MAP OF THE SOUTHWESTERN PART OF THE TYONEK B-5 QUADRANGLE, SOUTH-CENTRAL ALASKA

By

Lynn A. Yehle, Henry R. Schmoll, and Alan F. Chleborad

1983

CORRELATION OF MAP UNITS



INTRODUCTION

The Tyonek B-5 quadrangle lies about midway between Cook Inlet and the Tordrillo Mountains (index map) whose southerly peak is the active volcano, Mount Spurr, 3,375 m high. For presentation of our surficial geologic information we divided the area into three parts; the southeastern and northern parts are described respectively on companion maps (Yehle, Schmoll, and Chleborad, 1983; Yehle, Schmoll, and Gardner, 1983). In the southwestern part, wholly within the Kenai Peninsula Borough, physiographic elements include the retreating Capps Glacier and its valley, an adjacent gently rolling upland, and a volcanic plateau (fig. 1). Slopes are steep to very steep along the valley margin, the plateau rim, and in the northern part of the area adjacent to Triumvirate south river, the informally named southerly outwash channel of Triumvirate Glacier. A variably thick mantle of organic material and interbedded volcanic ash forms an irregular cover over most of the land surface; in many places the mantle is about 1 m in thickness. Only on very steep slopes and on flood plains of active streams is the mantle not present. The ash originated from Mount Spurr as well as from other volcanoes in the region (Riehle, 1983). Significant glacial features include the young end and lateral moraines of late Holocene age adjacent to Capps Glacier and remnants of Denslow Lake lateral moraines of late Pleistocene age on the upland; the relationship of these moraines to regional glacial geology is outlined in Schmoll and Yehle (1983). Landslides of all sizes are very common; two major complexes of slides are southeast of the terminus of Capps Glacier and in the southwest corner of the map. Many of the landslides are active and founded in claystone and siltstone of the Tertiary Tyonek Formation. This formation also includes some sandstone and coal beds. Proposed coal mining (fig. 1) would exploit parts of the Capps bed, about 5.5 m thick, and the Waterfall bed, about 10.4 m thick (Placer Amex, Inc., 1977). Rocks of the Tyonek Formation underlie much of the area, and although so poorly exposed that they are not shown on the generalized map of published bedrock data (fig. 2), the rocks probably underlie the area between Capps Glacier and Triumvirate south river and much of the plateau that is capped by volcaniclastic deposits of Tertiary and Quaternary(?) age. Sandstone and conglomeratic sandstone of the Tertiary West Foreland Formation are well exposed south of Capps Glacier. Metamorphic rocks of Jurassic to Cretaceous age underlie some terrain in the northwest part of the area.

DESCRIPTION OF MAP UNITS

The map delineates deposits considered to be about 1 m or more in thickness. Thicknesses given for deposits generally are estimates based on field observations. Grain sizes of unconsolidated particles described follow the classification of Wentworth (1922). Standard age symbols are omitted from map symbols because all units except bedrock and volcaniclastic strata are entirely of Quaternary age.

MORAINE DEPOSITS

Till, primarily diamicton, consisting of gravel in a silty and variable amounts of clay; clasts as large as boulders. Generally unsorted, but locally well sorted, as discontinuous lenses of sand to sandy pebble gravel. Moderately compact. Formed into ridges, hummocky ground, and some relatively smooth plains. In places includes scattered bedrock exposures too small to show at 1:31,680 scale

END- AND LATERAL-MORAINE DEPOSITS--Chiefly diamicton formed into heterogeneous assemblage of landforms some of which are steep-sided ridges as much as 10 m high. Diamicton locally may contain many cobbles and boulders. Includes some kame, outwash, pond, alluvial, and peat deposits too small to map at 1:31,680 scale. Thickness less than 25 m

yma Actively forming end-moraine and related drift deposits (late Holocene)--Includes ground-moraine, kame, outwash, and pond deposits in the process of formation, with some subsequent modification through mass wastage or destruction by younger outwash streams. Mapped only beyond 1978 terminus of Capps Glacier where ice has melted or partly melted since 1952, as interpreted from August 1978 color infrared airphotos; 1978 position of lateral margin of glacier not mapped because not clearly distinguishable from 1952 position. The date of airphotos used to construct the topographic base map is 1952. An estimated maximum rate of retreat of the glacier front is about 40 m/yr. A possible 1983 position of the glacial terminus based upon this rate is shown at one location

yme End- and lateral-moraine deposits of young advance of Capps Glacier (late Holocene)--Form several well-developed, mostly steep-sided ridges, which progress from very sparsely to fully vegetated with increasing distance from the glacier front. In many places diamicton has a relatively sandy matrix. Includes many patches of ground-moraine, kame, and outwash deposits too small to map at 1:31,680 scale. Glacial advance may have terminated within last century, based on fresh appearance of inner moraines and the age of about 80 yrs (A.D. 1900) for one of larger spruce trees rooted in outwash graded to the outermost moraine of young advance of similar-sized Triumvirate Glacier 3 km north of mapped area

hme Lateral-moraine deposits of the Chichantna moraine (early? Holocene)--Distributed mainly north and northeast of Capps Glacier. In narrow, well-defined moraines that seem to be continuous with the Chichantna end moraine (Yehle, Schmoll, and Chleborad, 1983) that loops across the Chichantna River valley 8 km east of the 1952 terminus of Capps Glacier. Age assignment is tentative and is based on preliminary interpretation of a ^{14}C date of 7,750±200 yr B.P. (W-4056, Meyer Rubin, written commun., 1978) as a minimum time for ice retreat from the lateral moraine. Dated material is from base of a bog which overlies diamicton of the lateral moraine. Sample site: NW1/4NE1/4 sec. 28, T. 15 N., R. 14 W., letter A on map and on figure 1

me Lateral- and recessional-moraine deposits related to or part of the Denslow Lake moraine (late Pleistocene)--Form moraines having gentle sides. Outermost lateral moraines are discontinuously traceable from north edge of the volcanic plateau eastward to margin of area of massive landslides (fig. 1). Recessional moraines are present as semicontinuous and scattered deposits toward Capps Glacier from the eastermmost lateral moraines, as well as on the drainage divide between Capps Glacier and Triumvirate south river. Lateral moraines are discontinuously traceable southeastward to Denslow Lake (see index map; Yehle, Schmoll, and Chleborad, 1983). Age assignment is tentative and is based on morphologic similarity to the Elmendorf Moraine at Anchorage, Alaska (index map), which is age bracketed by ^{14}C-dated geologic materials as younger than 14,000 and older than 12,000 yr B.P. (Schmoll and others, 1972). The Denslow Lake moraine was previously termed the Carlson Lake moraine by Schmoll and others (1981)

mh HUMMOCKY MORAINE DEPOSITS RELATED TO THE DENSLOW LAKE MORAINE (LATE PLEISTOCENE)--Diamicton forming landforms having uneven surface topography and very little or no linear continuity. Diamicton may contain a high percentage of coarse clasts. Large area of deposits scattered southeast of Capps Glacier and north of North Capps Creek. Thickness as much as 10 m

GROUND-MORAINE DEPOSITS--Form mostly low, rolling mounds on gentle to moderate slopes or on small plains of low relief

yng Ground-moraine deposits of young advance of Capps Glacier (late Holocene)--Chiefly near 1952 terminus of Capps Glacier and adjacent to end-moraine ridges of young advance of Capps Glacier. Thickness less than 5 m

hmg Ground-moraine deposits related to the Chichantna moraine (early? Holocene)--Scattered deposits downslope from lateral moraines and mostly north and northeast of Capps Glacier. Thickness less than 5 m

Deposits consisting of ground moraine or mostly ground moraine and related to the Denslow Lake moraine

mg Ground-moraine deposits (late Pleistocene)--Widely distributed near Capps and North Capps Creeks and near ridge between Capps Glacier and Triumvirate south river. Thickness less than 7 m

mgt Thin ground-moraine deposits.--Less than 2 m in thickness; bedrock exposures locally common. Scattered distribution south of Capps Glacier

md Extensively dissected moraine deposits (late Pleistocene)--Areas where deposits are extensively cut by very numerous narrow, shallow gullies; gullies range in depth from 1 to 4 m. As mapped, includes bedrock exposed along margins of some small gullies, most of which contain intermittent streams. Some gullies expose bedrock along their margins; most streams in gullies are intermittent. Located southwest of Triumvirate south river and includes some alluvial and colluvial deposits too small to show at 1:31,680 scale. Thickness less than 5 m

mc Channeled moraine deposits (late Pleistocene)--Chiefly ground-moraine deposits in areas containing so many abandoned glacial-meltwater channels that they are too numerous or too small to show individually at 1:31,680 scale. Most channels are parallel to topographic contours and range in depth from 2 to 10 m; as mapped, includes bedrock exposed along margins of some channels. Selected channels shown on map. A few deposits located northeast of Capps Glacier. Also includes some peat and pond deposits. Thickness less than 5 m

om OLD MORAINE DEPOSITS (PLEISTOCENE)--Composed mostly of ground-moraine deposits but may include some lateral-moraine deposits near east rim of the volcanic plateau (fig. 1). Compared with other moraine deposits, these deposits are generally thinner, probably averaging 3 m, and commonly are covered by the maximum thickness of the mantle of organic material and volcanic ash, probably averaging 1 m. Found chiefly east of the volcanic plateau

omt Thin old moraine deposits.--Thickness possibly averages 2 m. As mapped, includes locally common bedrock exposures. Widely distributed in southeastern part of the map area

k KAME AND OTHER ICE-CONTACT DEPOSITS RELATED TO THE DENSLOW LAKE MORAINE (LATE PLEISTOCENE)

Mostly gravelly sand and some poorly sorted gravelly silty sand and diamicton in landforms ranging from irregularly shaped kame hills to almost smooth kame terraces. Most deposits loose, some compact. A few deposits near North Capps Creek in sec. 22, T. 14 N., R. 14 W. Thickness less than 15 m

OUTWASH DEPOSITS

Mostly bedded sandy gravel and sand deposited by glacial meltwaters on wide, low-gradient plains or in small, generally narrow, diamicton- or bedrock-bounded channels commonly approximately parallel to topographic contours. Most deposits loose and moderately well sorted; commonly more gravelly at depth. Active modern outwash emanating from receding Capps Glacier is mapped chiefly as flood-plain alluvial deposits (ap)

yo OUTWASH-PLAIN DEPOSITS GRADED TO MORAINES OF YOUNG ADVANCE AND TO SOME OF THE ACTIVELY FORMING MORAINE AND RELATED DRIFT DEPOSITS (yma) OF CAPPS GLACIER (LATE HOLOCENE)--Thickness as much as 20 m

oo OUTWASH DEPOSITS RELATED TO THE OLD MORAINE DEPOSITS (PLEISTOCENE)--Deposited in several broad areas adjacent to modern east fork Chuitna River and nearby streams in southeastern part of mapped area. As mapped, includes small areas underlain by peat deposits (pt) too small to map at 1:31,680 scale. Adjacent mapped peat deposits in many places are thought to conceal thin outwash deposits. Thickness probably less than 8 m

oc OUTWASH-CHANNEL DEPOSITS (HOLOCENE AND PLEISTOCENE)--Distributed throughout area north of Capps Glacier and northeast and east of the volcanic plateau. Near Capps Glacier several channels reoccupied by meltwater during subsequent glacial event. Commonly overlain by pond or peat and other organic deposits too small to map at 1:31,680 scale. Thickness as much as 5 m

ALLUVIAL DEPOSITS

a ALLUVIAL DEPOSITS, UNDIVIDED (HOLOCENE)--Mostly pebbly sand to some cobble gravel deposited by small, medium, and some large streams of low to moderate gradient; includes deposits in low terraces. Bedded and moderately well sorted within beds. Distributed throughout area; on volcanic plateau (fig. 1) lithologies overwhelmingly volcanic, elsewhere, various lithologies. Thickness as much as 15 m but much less along small streams

af FINE-GRAINED ALLUVIAL DEPOSITS (HOLOCENE)--Chiefly sand and some small pebbles, silt, and organic material deposited by small, generally low gradient streams. Commonly uniformly bedded. Widely distributed in southeastern part of mapped area. Thickness less than 5 m

ap FLOOD-PLAIN ALLUVIAL DEPOSITS (HOLOCENE)--Mostly pebbly sand to cobble gravel and sand deposited on the presently active flood plain and the lowest generally unvegetated terraces of large streams like the Chichantna River and Triumvirate south river (fig. 1). Well bedded and commonly well sorted within beds. Originates chiefly as present-day outwash from Capps Glacier and from Triumvirate Glacier directly north of mapped area. Thickness as much as 20 m

at ALLUVIAL-TERRACE DEPOSITS (HOLOCENE)--Chiefly sandy gravel and sand forming terraces several meters or more higher than adjacent active flood plain. Well bedded and commonly well sorted within beds. Several deposits west of Triumvirate south river. Thickness less than 10 m

f ALLUVIAL-FAN DEPOSITS (HOLOCENE)--Mostly gravel and gravelly sand deposited where active, steep-gradient streams reach moderate to gentle slopes. Irregularly bedded; poorly to moderately well sorted within beds. Occur mainly at base of escarpments around the volcanic plateau and marginal to the massive landslide areas (fig. 1). Thickness as much as 15 m

ff FINE-GRAINED ALLUVIAL-FAN DEPOSITS (HOLOCENE)--Chiefly sand and gravelly sand deposited by medium-gradient streams. Some deposits are the fine phase of coarser alluvial-fan deposits. A few deposits southwest of Capps Glacier and near east fork Chuitna River (fig. 1). Thickness as much as 10 m

COLLUVIAL AND LANDSLIDE DEPOSITS

Colluvial deposits consist of irregularly mixed fragments of various sizes derived from bedrock and chiefly gravity processes acting on older geologic materials. Chiefly diamicton consisting of gravelly or rubbly silt and sand and, locally, some organic material. Generally unsorted. Loose to compact. Landslide deposits consist of numerous types of unconsolidated geologic materials and bedrock in simple to complex types of landslides that in part grade into one another. Surface varies from very irregular and hummocky to almost smooth. Widely distributed in the mapped area except through the middle part. Prominent are three major landslide areas (fig. 1), parts of which extend beyond the mapped area: (1) north of the broad ridge north of Capps Glacier, (2) southeast of Capps Glacier, and (3) in the southwest corner of the mapped area. Signs of recent activity such as cracked and broken ground, a lack of vegetation, and small ponds are present at and near the heads and toes of many landslides, especially where debris-flow, mudflow, and debris-avalanche deposits are present

ca MIXED DEPOSITS OF COLLUVIUM AND MOSTLY FINE-GRAINED ALLUVIUM (HOLOCENE)--In areas where colluvial deposits are crossed by so many small watercourses and their alluvial deposits that the alluvial deposits are too numerous to map separately at 1:31,680 scale. Slopes generally moderate to gentle. Widely scattered throughout mapped area. Thickness as much as 5 m

c COLLUVIAL DEPOSITS, UNDIVIDED (HOLOCENE AND PLEISTOCENE)--Sources of deposits are both bedrock and unconsolidated materials. Mostly on steep to moderate slopes, notably along present or abandoned stream courses throughout mapped area. Thickness less than 5 m

cb COLLUVIAL DEPOSITS DERIVED CHIEFLY FROM BEDROCK (HOLOCENE AND PLEISTOCENE)--On steep to moderately steep bluffs adjacent to present or abandoned stream courses and on relatively steep to moderate slopes north and south of Capps Glacier and west and southwest of Triumvirate south river. In many places includes numerous bedrock outcrops. Thickness less than 3 m

cv COLLUVIAL DEPOSITS DERIVED FROM THE UNDIVIDED VOLCANICLASTIC AND TEPHRA DEPOSITS (HOLOCENE AND PLEISTOCENE)--On steep to moderately steep escarpments and on some gentle slopes. Confined to summit and margins of the volcanic plateau (fig. 1). As mapped, locally includes small outcrops of the volcaniclastic deposit (v). Thickness less than 2 m

cl LANDSLIDE DEPOSITS, UNDIVIDED (HOLOCENE AND PLEISTOCENE)--Deposits scattered extensively throughout the mapped area. Thickness possibly as much as 100 m. Queried where identity is somewhat uncertain

clb BLOCK-SLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)--Deposits showing very slight to moderate spreading of original ground surface. The present surface gives appearance of no more than a moderate amount of disruption between blocks; some blocks are as much as several hundreds of meters in longest dimension, especially between Capps Creeks in the massive landslide area. Thickness of most blocks probably less than 60 m but some possibly as much as 100 m thick

clf Fragmented block-slide deposits (Holocene and Pleistocene)--Deposits consisting mostly of blocks that were originally much larger but now are broken apart and spread out because of continued movement. Thickness less than 15 m

cls SLUMP DEPOSITS (HOLOCENE AND PLEISTOCENE)--Deposits that appear to have rotated at least several degrees from a vertical plane, slid downslope, and then spread out. Thickness less than 60 m

cld DEBRIS-FLOW, MUDFLOW, AND DEBRIS-AVALANCHE DEPOSITS (HOLOCENE AND PLEISTOCENE)--Deposits that may have formed by flowage of parent material. Found scattered throughout landslide areas. Deposits probably less than 5 m in thickness

LACUSTRINE DEPOSITS

d DELTA DEPOSITS (HOLOCENE)--Mostly pebble gravel and sand deposited by Triumvirate south river at the margin of Beluga Lake (altitude 75 m, 246 ft) located directly northeast of map area. Deposits probably finer grained at depth. Thickness as much as 50 m

ls EMERGED-SHORE DEPOSITS (HOLOCENE)--Mostly pebbly sand and probably some silt deposited at margin of ancestral Beluga Lake. Deposits occur as much as 70 m above present lake level. In places, well-developed beach berms have been shown on the map as lineaments. Thickness less than 3 m

POND DEPOSITS (HOLOCENE)

p Chiefly organic-rich silt and organic-rich very fine sand and adjacent to modern ponds and lakes. In many places includes organic deposits too small or too numerous to show at 1:31,680 scale. Several deposits near landslides and in southeastern part of mapped area. Near the 1952 terminus of Capps Glacier, includes several deposits of silt and sand adjacent to ponds related to melting of the glacier. Adjacent mapped deposits extend beneath the pond deposits. Thickness as much as 4 m

PEAT AND OTHER ORGANIC DEPOSITS (HOLOCENE AND LATE PLEISTOCENE)

pt Organic materials, chiefly mosses, sedges, and some wood fragments, in varying states of decomposition. Includes some silt, very fine sand, and numerous layers of volcanic ash. Soft and moist. As mapped, unit in many places includes pond deposits too small to show at 1:31,680 scale. Adjacent mapped deposits extend beneath the peat deposits. Several deposits in southeastern part of mapped area. Thickness less than 4 m

TEPHRA DEPOSITS (HOLOCENE AND PLEISTOCENE?)

t Ash and lapilli accumulated chiefly by air fall onto the volcanic plateau in southwestern part of the mapped area. Materials comprise a thicker part (probably averaging 1.5 m or more) of the typical mantle covering most deposits in the mapped area. On the volcanic plateau, however, individual tephra layers are thicker and more numerous and no organic interlayers were seen. Deposits cover the volcaniclastic deposits (v) irregularly and are absent locally. Part of the irregularity is the result of (1) nonuniform initial deposition, (2) differential erosion by streams, or (3) differential wind action, resulting in localized deflation in some places and formation of small dunes in other places

VOLCANICLASTIC DEPOSITS (QUATERNARY? AND TERTIARY)

v A sequence of relatively continuous beds consisting of pebble-, cobble-, and boulder-sized overwhelmingly volcanic clasts in a scant matrix of sand and granules and some silt and clay. Forms a volcanic plateau in the southwestern part of the mapped area. Clasts are chiefly subangular, but many are angular, and locally some are subrounded to rounded. Lithologies overwhelmingly consist of dense to vesicular volcanic rock types; locally, however, several percent of granitic and, rarely, other rock types present; nonvolcanic clasts commonly subrounded. Matrix commonly indurated but locally semi-indurated to loose. Largely horizontally bedded but steeply dipping locally in secs. 17, 19, and 28, T. 14 N., R. 14 W. One local bed rich in pumice and one bed of tuff(?) were found in sec. 19, T. 14 N., R. 14 W.; other tuff(?) beds noted in sec. 28, T. 14 N., R. 14 W. Thickness about 75 m near Capps Glacier (Barnes, 1966) thinning southeastward to possibly 10 m. Unit may constitute part of a sequence of volcanic mudflow and (or) pyroclastic-flow deposits which filled a former valley having a southeasterly gradient. Some beds may be of glacial origin

BEDROCK (TERTIARY TO JURASSIC)

b Exposed in steep to moderately steep bluffs and escarpments throughout mapped area, especially south of Capps Glacier and along Capps and North Capps Creeks. Many scattered bedrock exposures also present within areas underlain by the colluvial deposits, undivided (c), and colluvial deposits derived chiefly from bedrock (cb). General rock types (fig. 2) mapped or indicated by Barnes (1966), Detterman and others (1976), Magoon and others (1976), Manning and Hinderman (1979), Beikman (1980), and Merritt and others (1982) include the following: (1) mostly metamorphic rocks of Jurassic to Cretaceous age in areas west of Triumvirate south river; (2) sedimentary rocks, chiefly sandstone and conglomeratic sandstone of the West Foreland Formation of latest Paleocene age (Wolfe and Tanai, 1980), south and southwest of Capps Glacier and in the southeastern part of the mapped area; and (3) sedimentary rocks, chiefly siltstone, claystone, sandstone, and several coal beds of the Tyonek Formation (lower Oligocene through middle Miocene) of the Kenai Group (Wolfe and Tanai, 1980) southeast of Capps Glacier and along Capps Creeks and its tributaries. Principal coal beds are the Capps bed, about 5.5 m thick, and the stratigraphically lower Waterfall bed, about 10.4 m in thickness (Placer Amex, Inc., 1977). Proposed areas for mining these beds are shown in figure 1. Both coal beds and overlying and underlying rocks were drilled during two hole-coring and preliminary rock-testing operations (loc. 1, total depth 140 m, and loc. 2, total depth 61 m, map and fig. 1; Chleborad and others, 1980, 1982, respectively). Selected samples including coal from each hole have been geochemically analyzed or combustion tested (U.S. Geological Survey coal sample nos. D228730 through D228736 and D240919 through D240926, respectively; R. T. Hildebrand, written commun., 1982; Hinkley and others, 1982)

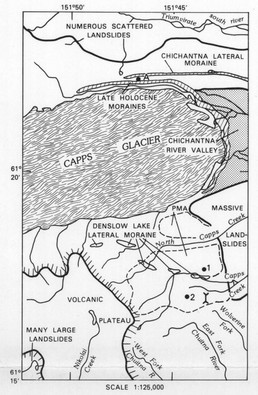


Figure 1.--Selected physiographic, hydrographic, and cultural features. A, site of sample providing ^{14}C date for Chichantna lateral moraine deposits; PMA, proposed mining areas (Placer Amex, Inc., 1977); 1, drill hole USGS 1C-79 (Chleborad and others, 1980); 2, drill hole USGS 2C-80 (Chleborad and others, 1982); ⟩—⟨, trench developed by Placer Amex, Inc., for coal sampling.

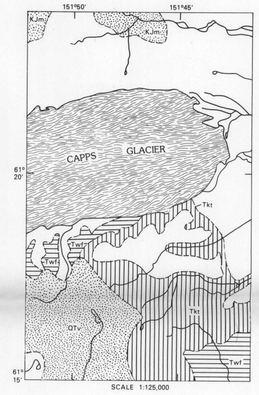
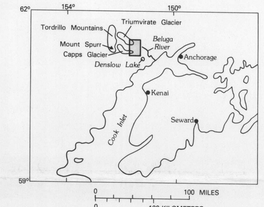


Figure 2.--Generalized bedrock geology from Barnes (1966), Detterman and others (1976), Magoon and others (1976), Manning and Hinderman (1979), Beikman (1980), and Merritt and others (1982). QTv, Quaternary(?) and Tertiary volcaniclastic deposits; Tkt, Tertiary Kenai Group Tyonek Formation, fine-grained sedimentary rocks; Twf, Tertiary West Foreland Formation, coarse-grained sedimentary rocks; KJm, Cretaceous and Jurassic metamorphic rocks.



INDEX MAP SHOWING LOCATION OF TYONEK B-5 QUADRANGLE (SHADED)

REFERENCES CITED

Barnes, F. F., 1966, Geology and coal resources of the Beluga-Yentna region, Alaska: U.S. Geological Survey Bulletin 1202-C, 54 p.

Beikman, H. M., compiler, 1980, Geologic map of Alaska: U.S. Geological Survey, scale 1:2,500,000.

Chleborad, A. F., Yehle, L. A., Schmoll, H. R., and Gardner, C. A., 1980, Preliminary field geotechnical and geophysical logs from a drill hole in the Capps coal field, Cook Inlet region, Alaska: U.S. Geological Survey Open-File Report 80-393, 17 p.

Chleborad, A. F., Yehle, L. A., Schmoll, H. R., Gardner, C. A., and Dearborn, L. L., 1982, Preliminary geotechnical and geophysical logs from drill hole 2C-80 in the Capps coal field, Cook Inlet region, Alaska: U.S. Geological Survey Open-File Report 82-884, 11 p.

Detterman, R. L., Hudson, Travis, Plafker, George, Tysdal, R. G., and Hoare, J. M., 1976, Reconnaissance geologic map along Bruin Bay and Lake Clark faults in Kenai and Tyonek quadrangles, Alaska: U.S. Geological Survey Open-File Report 76-477, 4 p.

Hinkley, T. K., Smith, K. S., Peard, J. L., and Tompkins, M. L., 1982, Whole-rock chemical composition of some samples from two drill hole cores in the Capps coal field, Beluga coal area, south-central Alaska: U.S. Geological Survey Open-File Report 82-672, 50 p.

Magoon, L. B., Adkison, W. L., and Egbert, R. M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geological Survey Miscellaneous Investigations Series Map I-1019, scale 1:250,000.

Manning, K. H., and Hinderman, T. K., 1979, Uranium resource evaluation--Tyonek quadrangle, Alaska: U.S. Department of Energy Open-File Report PGJ-059(81), 18 p. [prepared by C. C. Hawley and Associates].

Merritt, R. D., Eakins, G. R., and Clough, J. G., 1982, Coal investigations of the Susitna Lowland, Alaska: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report AOF 142, 42 p.

Placer Amex, Inc., 1977, Beluga coal project status report: Unpublished information available from Placer Amex, Incorporated, Suite 2500, One California Building, San Francisco, Calif. 94111, 58 p.

Riehle, J. R., 1983, Preliminary Holocene tephrochronology of the upper Cook Inlet region of Alaska: Geological Society of America Abstracts with Programs, v. 15, no. 5, p. 331-332.

Schmoll, H. R., Chleborad, A. F., Yehle, L. A., Gardner, C. A., and Pasch, A. D., 1981, Reconnaissance engineering geology of the Beluga coal resource area, southcentral Alaska, in Rao, P. D., and Wolff, R. N., eds., Focus on Alaska's Coal '80, Conference, Fairbanks, Alaska, October 21-23, 1980, Proceedings: University of Alaska Mineral Industry Research Laboratory MIRL Report 50, p. 92-110.

Schmoll, H. R., Szabo, B. J., Rubin, Meyer, and Dobrovolny, Ernest, 1972, Radiometric dating of marine shells from the Bootlegger Cove Clay, Anchorage area, Alaska: Geological Society of America Bulletin, v. 83, no. 4, p. 1107-1114.

Schmoll, H. R., and Yehle, L. A., 1983, Glaciation in the upper Cook Inlet: a preliminary reexamination based on geologic mapping in progress: University of Alaska Museum Occasional Paper 2 (in press).

Wentworth, C. K., 1922, A scale of grade and class terms for clastic sediments: Journal of Geology, v. 30, no. 5, p. 377-392.

Wolfe, J. A., and Tanai, Toshimasa, 1980, The Miocene Seldovia Point Flora from the Kenai Group, Alaska: U.S. Geological Survey Professional Paper 1105, 52 p.

Yehle, L. A., Schmoll, H. R., and Chleborad, A. F., 1983, Preliminary surficial geologic map of the southeastern part of the Tyonek B-5 quadrangle, south-central Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1661-C, scale 1:31,680.

Yehle, L. A., Schmoll, H. R., and Gardner, C. A., 1983, Preliminary surficial geologic map of the northern part of the Tyonek B-5 quadrangle, south-central Alaska: U.S. Geological Survey Miscellaneous FIeld Studies Map MF-1661-A, scale 1:31,680.

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1983

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225